A NEW GENUS AND SPECIES OF SCALLOP (BIVALVIA: PECTINIDAE) FROM OFF SOMALIA, AND THE DEFINITION OF A NEW TRIBE DECATOPECTININI

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ABSTRACT

Somalipecten *Waller, new genus, is one of ten extant pectinid genera that are placed in the new tribe Decatopectinini, which is characterized by low early beak inflation, very closely spaced commarginal lamellae, and very weak or absent resilial hinge teeth. The type species,* Somalipecten cranmerorum, *new species, from off Somalia in 150-300 m, is the sole survivor of a group of congeneric species that lived in the Neogene and Quaternary of the Red Sea and western Indian Ocean regions.*

Introduction

Many new species of shelled mollusks are still being discovered in the world's oceans, but it is remarkable when a new species turns out to be large in size, exquisitely beautiful in color and form, and also abundant at its type locality in a region thought to have a well-known molluscan fauna. In this report I describe a new scallop, *Somalipecten cranmerorum*, new genus and species, taken by Taiwanese trawlers working new fishing grounds off Somalia. This new pectinid genus, which has an extensive fossil record in Neogene and Quaternary strata adjacent to the Red Sea and western Indian Ocean, is one of ten extant genera that comprise a *new tribe*, Decatopectinini.

The system of measurement used here follows that in Waller (1969, 1972), in which shell height is measured as the perpendicular distance between the active outer ligament or hingeline and a parallel line drawn through the most ventral point on the ventral margin. References to numbers of teeth in the ctenolium refer only to the active ctenolium (Waller, 1984), not the inactive ctenolium partially obscured by the growth of the anterior auricle. The umbonal angle is the angle between lines diverging from the origin of growth and passing through the estimated points of union between the free margins of the auricles and the disk flanks. Observation of microsculpture was by means of a Wild M-5 binocular microscope at magnifications not exceeding ×50. Measurement employed an ocular micrometer as well as a goniometer eyepiece.

The term *antimarginal* is introduced with reference to microsculpture that maintains a nearly perpendicular relationship to the shell margin, exemplified by the *Camptonectes* microsculptural pattern (illustrated in Waller, 1972). In contrast, sculptural features such as plicae, which are described as radial, are perpendicular to the shell margins only in the midventral region and may be nearly parallel to margins in the region of the disk flanks. These terms complement the term commarginal, which has come into broad usage for features that are parallel to shell margins. I also propose new terms found to be useful for the description of hinge teeth in the Pectinacea. In the right valve, *resilial teeth* originate near the origin of growth of the shell and approximately parallel the anterior and posterior sides of the resilium, at least in early ontogeny. One such tooth borders each side of the resilium, as in *Chlamys islandica* (Müller, 1776). *Dorsal teeth* lie immediately ventral to the outer ligament, one such tooth bordering the outer ligament on each side of the hinge, and may originate at some distance from the origin of growth (arrows in Fig. 13). *Intermediate teeth* lie between resilial and dorsal teeth, are commonly differentially developed on the anterior

and posterior sides of the hinge, and may be multiple, as in *Decatopecten* and *Pecten*.

The anatomy of *Somalipecten cranmerorum* cannot be described at present, because no soft parts were available to me.

Systematics

Class **Bivalvia** Linnaeus, 1758

Subclass **Pteriomorphia** Beurlen, 1944 [*emend.*, Boss, 1982]

Superorder **Eupteriomorphia** Boss, 1982

Order **Ostreoida** Waller, 1978

Suborder **Pectinina** Waller, 1978

Superfamily **Pectinacea** Rafinesque, 1815 [*emend.*, Waller, 1978]

Family **Pectinidae** Rafinesque, 1815 [*emend.*, Waller, 1978]

Subfamily **Pectininae** Rafinesque, 1815

Tribe **Decatopectinini**, *new tribe*

Diagnosis: Pectinidae having very closely spaced commarginal lamellae at least in early ontogeny and commonly throughout life, the spacing commonly ranging from about 30 to 70 lamellae per two-millimeter distance along a radius in center of disk at height of 10 mm; inflation of left beak very low, only very slightly exceeding that of right beak, the left beak extending only very slightly dorsal to hingeline; antimarginal microsculpture very fine and restricted to early ontogeny of disk to a distal limit slightly beyond origins of radial plicae, absent from disk flanks and auricles; dentition dominated by dorsal and/or intermediate teeth, the latter sometimes multiple or sometimes absent; resilial teeth low or absent.

Type Genus: Decatopecten Rüppel in Sowerby, 1839.

Taxonomic Composition—The new tribe contains the following extant genera, listed with their type species, geographic region, and some common synonyms:

Anguipecten Dall, Bartsch, and Rehder, 1938, type species *Anguipecten gregoryi* Dall, Bartsch, and Rehder, 1938 [junior synonym of *Pecten lamberti* Souverbie *in* Sourverbie and Montrouzier, 1871], tropical Indo-Pacific.

Annachlamys Iredale, 1939, type species *Pecten leopardus* Reeve, 1853 [junior synonym of *Pecten flabellatus* Lamarck, 1819], tropical western Pacific and eastern Indian Oceans.

Bractechlamys Iredale, 1939, type species *Bractechlamys erecta* Iredale, 1939 [junior synonym of *Pecten vexillum* Reeve, 1853], tropical Indo-Pacific and Western Atlantic.

Decatopecten Rüppel in Sowerby, 1839 [senior synonym of *Comptopallium* Iredale, 1939], type species *Ostrea plica* Linnaeus, 1758, tropical Indo-Pacific.

Excellichlamys Iredale, 1939, type species *Pecten spectabilis* Reeve, 1853, tropical Indo-Pacific.

Flexopecten Sacco, 1897 [senior synonym of *Glabropecten* Sacco, 1897, *Lissopecten* Verrill, 1897, and *Proteopecten* Monterosato, 1899], type species *Ostrea flexuosa* Poli, 1795, Mediterranean and adjacent eastern Atlantic.

Gloripallium Iredale, 1939, type species *Ostrea pallium* Linnaeus, 1758, tropical Indo-Pacific.

Juxtamusium Iredale, 1939, type species *Juxtamusium oblectatum* Iredale, 1939 [junior synonym of *Pecten (Chlamys) coudeini* Bavay, 1902], tropical western Pacific and Indian Oceans.

Mirapecten Dall, Bartsch, and Rehder, 1938, type species *Mirapecten thaanumi* Dall, Bartsch, and Rehder, 1938 [junior synonym of *Pecten mirificus* Reeve, 1853], tropical Indo-Pacific.

Somalipecten Waller, *new genus*, type species *Somalipecten cranmerorum* Waller, *new species* described herein, tropical western Indian Ocean.

Stratigraphic Range: Paleocene to present.

Discussion: In view of the common assumption that commarginal increments in many bivalves are periodic, indicative of growth rate, and hence subject to environmental modification, it would seem inappropriate to use commarginal spacing as one of the prime morphological differentia for a tribe. However, evidence is accumulating showing that growth increments are not always periodic and may occur in ways that are taxonomically specific and hence genetically determined (Jones, 1981; Ohno, 1985). Recently, Helm and Malouf (1983) suggested that there may be a minimal required distance between successive commarginal ridges in the Atlantic Bay Scallop, *Argopecten irradians* (Lamarck, 1819), and that this re-

quirement may override any periodicity when the rate of shell growth is low. Gruffydd (1981) showed that in *Pecten maximus* (Linnaeus, 1758) faster growth is achieved by increasing both the width of growth increments and the number of ridges formed per unit of time. Whatever the cause of projecting commarginal lamellae in the Pectinidae, it is clear that these features are more closely spaced in members of the tribe Decatopectinini than in other scallops at a comparable shell size at least during early ontogeny. With few exceptions, genera outside the Decatopectinini have fewer than 25 commarginal lamellae per two-millimeter space at a height of 10 mm, and many of these have as few as 5 to 15.

As can be seen from the above list of geographic ranges of genera, the Decatopectinini are largely Indo-Pacific at present, and my own unpublished data on fossil distributions indicates that the tribe has been primarily Indo-Pacific throughout its geologic history. The two exceptional genera which also occur in the Atlantic, *Bractechlamys* and *Flexopecten*, both appear to have dispersed into the Atlantic from the Indo-Pacific, but from opposite directions.

The relationship of *Nodipecten* Dall, 1898, and *Lyropecten* Conrad, 1862, to the Decatopectinini is close, but both of these genera have more-widely-spaced commarginal lamellae, stronger intermediate teeth, and coarser umbonal microsculpture. A full account of the morphological differences that distinguish genera in the Decatopectinini, as well as a discussion of fossil history, zoogeography, and relationships to other suprageneric units within the Pectinidae, is in preparation.

Somalipecten Waller, *new genus*

Type Species: Somalipecten cranmerorum Waller, new species, from off Somalia, depth 150 to 300 m.

Diagnosis: Plicate Decatopectinini having both valves convex, byssal notch only moderately deep, left umbo only slightly convex or flattened, and disk with uneven curvature, incipient ledging, or widely spaced nodes at least in early ontogeny; secondary radial costae present distally; auricular costae on right posterior auricle weakly developed and few in number or absent; enlarged scales, if present, limited to left valve; dentition dominated by dorsal teeth, intermediate teeth weak, resilial teeth commonly absent.

Taxonomic Content: The new genus includes a number of fossil species from the western Indian Ocean region described in publications by Cox (1929) and Eames and Cox (1956): *Chlamys (Aequipecten) farsanensis* Cox, 1929, *C. (A.) isthmica* (Fuchs, 1878), *C. (A.) leesi* Cox, 1929, *C. (A.) lessepsi* (Fuchs, 1878), *C. (A.) pseudola* Eames and Cox, 1956, *C. (A.) werthi* (Philippi, 1901), and *C. (A.) wyllei* Cox, 1929.

Stratigraphic Range: Upper Miocene to present. All of the fossil species listed above, with the exception of *S. pseudola*, are from deposits adjacent to the Red Sea (Egypt, Sudan, Saudi Arabia), the western Indian Ocean (Somalia, Kenya, Tanzania, Zanzibar), and the Arabian Sea (southeastern Saudi Arabia, Iran). Their age was called "post-Miocene" by Cox (1929), and some are probably as young as late Pleistocene or Holocene. *S. pseudola* from Iran was said by Eames and Cox (1956) to range from Upper Miocene to Pliocene. *Somalipecten cranmerorum*, new species, is the only known living species.

Comparison: A somewhat flattened left umbo is also present in *Annachlamys*, which differs from *Somalipecten* in having a wider umbonal angle, in having commarginal lamellae which revert to a far-set condition late in ontogeny, and in lacking nodes, enlarged scales, or extensive secondary radial costae. Some members of *Bractechlamys*, specifically *B. langfordi* (Dall, Bartsch, and Rehder, 1938) and *B. nodulifera* (Sowerby, 1842), have nodes and ledges but differ from *Somalipecten* in having persistent deep byssal notches, strong intermediate teeth, and strong costae on all auricles. Extant *Nodipecten* Dall, 1898, and fossil *Lyropecten* Conrad, 1862, and *Macrochlamis* Sacco, 1897, differ in having far-set commarginal lamellae and much stronger intermediate hinge teeth. *Flexopecten* of the Mediterranean and eastern Atlantic differs in hinge details, the right dorsal teeth being much weaker or absent, and lacks nodes or enlarged scales. *Mirapecten* maintains a deep byssal notch throughout ontogeny and has enlarged scales on at least the posterior plica of both valves. *Notochlamys* Cotton, 1930, differs from *Somalipecten* in having persistent shagreen microsculpture, and *Mesopeplum* dif-

fers in having far-set commarginal lamellae and prominent resilial teeth.

Somalipecten cranmerorum
Waller, *new species*
Figs. 1-13

Diagnosis: *Somalipecten* having four major plicae on right valve and three on left, the left valve also having a single plica of smaller amplitude adjacent to each disk flank; enlarged distally concave or enclosed scales few in number and widely spaced, limited to tops of plicae of left valve.

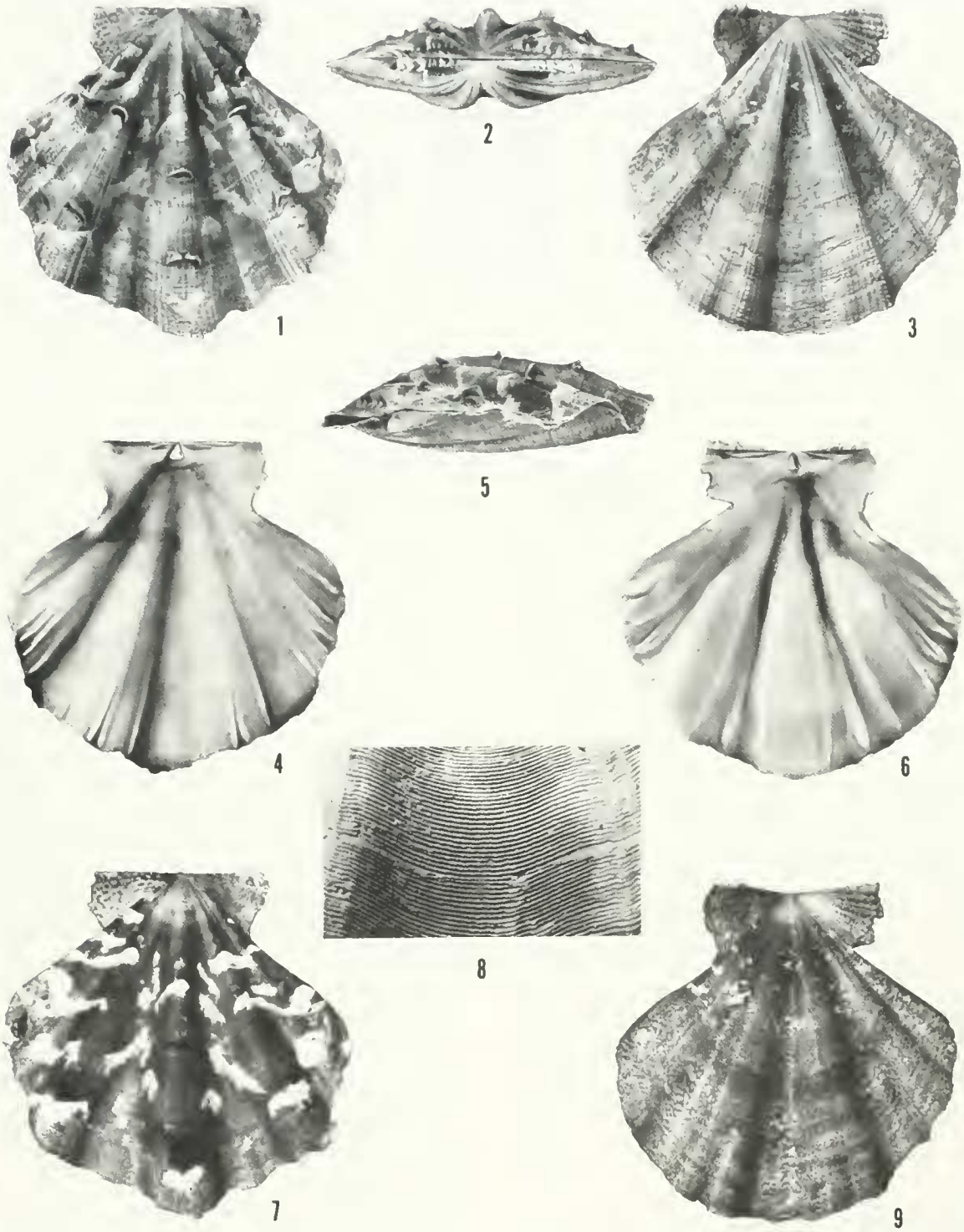
Description: Disk Outline—Moderately large, with height commonly 40 to 70 mm and seldom exceeding length, the ratio of height to length commonly 0.88 to 1.01; outline acline or slightly prosocline, rarely slightly opisthocline, and equilateral; anterior and posterior extremities of disk narrowly rounded, ventral margin broadly rounded; umbonal angle ranging from 93 to 104°; both valves convex, the right more so than the left, the umbone of left valve flattened; ratio of convexity of closed valves to height 0.22 to 0.37, averaging 0.31.

Auricle Outlines—Right anterior auricle with byssal notch only moderately deep, bordered on its ventral side by an active ctenolium of from 3 to 5 delicate, closely spaced teeth, which may be obsolescent in largest specimens; other auricles pointed, their free margins forming acute angles with hinge line; anterior auricles exceeding posterior in length, the ratio of length of anterior outer ligament to length of posterior outer ligament commonly 1.04 to 1.24; ventral migration of ligament system absent even in largest individuals.

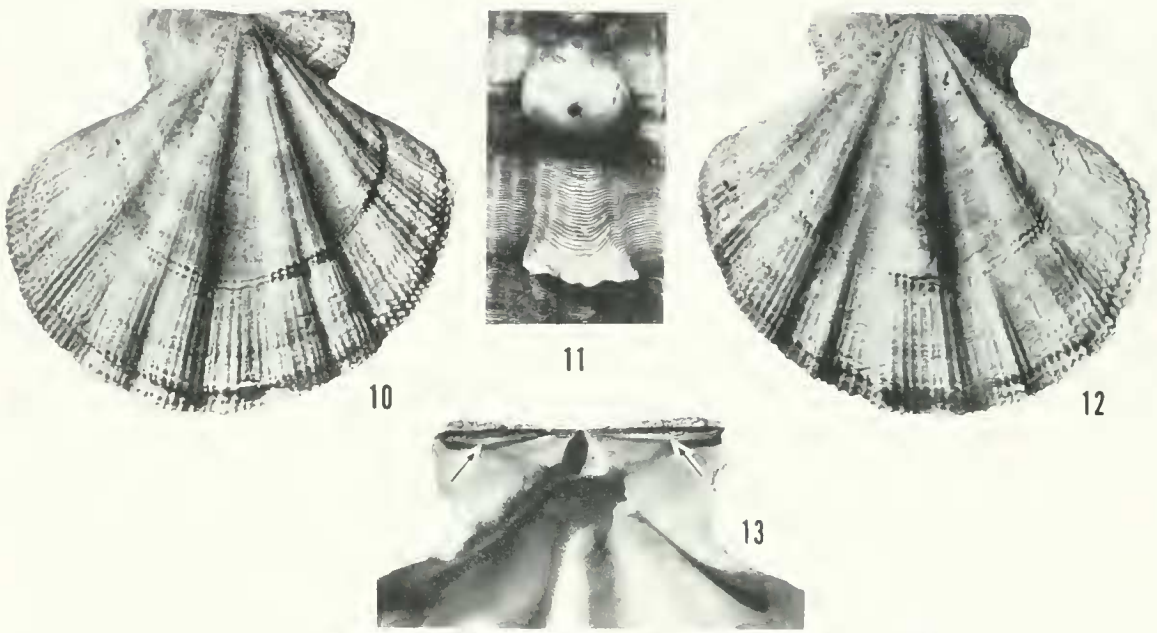
Exterior Shell Surface—Right disk with 4 major plicae, at least the central ones beginning at a shell height of between 2 and 3 mm as pairs of low rounded costae with narrow raised crests, each pair then merging into a single broad rounded plica at shell height of 10 to 15 mm, the broad plica becoming flattened and bifid with the introduction of a median groove at a shell height of about 35 to 40 mm; anteriormost major plica bordered anteriorly in early ontogeny by a single costa along edge of disk flank; posteriormost major plica bordered posteriorly by a pair of costae in early ontogeny. Left disk with three major plicae bordered on anterior and posterior by a single lower plica, the broad interspaces broken by introduction of smaller median plicae corresponding to the median grooves on right plicae. Secondary radial costae beginning on tops of right plicae at shell heights between 4 and 12 mm and across both plicae and interspaces of both valves by a height of 40 to 55 mm. Disk flanks without radial or antimarginal costae. Right anterior auricle commonly with 5 to 7 costae at margin; other auricles with highly variable costation, the right posterior auricle commonly lacking or having only a few costae. Enlarged, distally concave scales, sometimes closed to form hollow knobs, limited to tops of the five major plicae of left valve, few in number and widely spaced, commonly fewer than 5 per plica, rarely absent or as many as 8 per plica. One or two commarginal ledges commonly present in distal fourth of disk. Prismatic stage of right valve extending to shell height of 1.8 to 2.3 mm. Microsculpture on left beak and early postprismatic stage of right valve before start of commarginal lamellae consisting of exceedingly fine antimarginal striae. Commarginal lamellae closely spaced throughout ontogeny, first appearing in interspaces of right disk at shell heights between 4 and 6 mm.

Internal Features—Dentition with dorsal teeth dominant, intermediate teeth very weak or absent, resilial teeth absent. Single crus present on inner surface of shell beneath each disk flank, a second crus sometimes present on ventral fourth of posterior auricles; other crura or marginal denticles generally absent on inner surfaces of auricles. Inner surfaces of plicae with carinate edges and commonly with numerous radially elongate marginal denticles. Ostracum inside pallial line consisting entirely of lathic calcite with coarse irregular patches of folia; crossed lamellar aragonite absent in mature shells.

Color—Basal pigment red, orange-red, or orange, either solid or broken by exceedingly fine white mottling and/or by bold oblique bars or chevrons of white; dark pigment commonly present on ventral sides of enlarged scales. Pigment more subdued on right valve than on left, the bold patterns generally restricted to left valve. Beaks commonly with fine intersecting diagonal white lines. Interior of shell commonly pigmented outside pallial line and more rarely



FIGS. 1-9. Holotype of *Somalipecten cranmerorum* Waller, new genus and species, USNM 859034, length 53.8 mm, from off Somalia, 150-300 m. **1-6**, Left exterior, dorsal, right exterior, anterior, left interior, and right interior views, ammonium chloride coating. **7**, Left exterior, uncoated. **8**, Detail of commarginal lamellae in central interspace of right valve at heights between 14.7 and 17.1 mm, coated with ammonium chloride. **9**, Right exterior, uncoated.



FIGS. 10-13. Views of two paratypes of *Somalipecten cranmerorum* Waller, new genus and species, coated with ammonium chloride. **10.** Right exterior of the largest paratype, USNM 859035, length 80.5 mm, from off Somalia, 150-300 m. **11.** Closed scale with artificial perforation and an open scale on a central plica of left valve of another paratype returned to Mr. Dan, width of open scale 4.8 mm, shell height at level of open scale 57 mm. **12-13.** Left exterior and right hinge area of the largest paratype, USNM 835095, shell length 80.5 mm, hinge length 37 mm., arrows in Fig. 13 point to dorsal hinge teeth.

inside pallial line by the same color present on exterior.

Comparison: Somalipecten cranmerorum, new species, differs from all of the fossil species mentioned in the above discussion of *Somalipecten*, new genus, in having fewer major plicae. The smallest number of plicae among the fossil taxa occurs in *Somalipecten wyllei* (Cox, 1929), which has an additional pair of plicae on each valve, stronger intermediate hinge teeth, and no enlarged scales on the left valve. *S. cranmerorum* superficially resembles the more coarsely plicate varieties of *Flexopecten glaber* (Linnaeus, 1758) living in the Mediterranean, but that species lacks nodes and enlarged scales and differs in hinge details, as discussed above in the comparison of genera. None of the extant or extinct species of *Nodipecten* have as closely spaced commarginal lamellae, and they have much more massively developed dorsal and intermediate hinge teeth.

Ecology: The habitat of the new species is known only from the data provided by Taiwanese fishermen, who said that the shells were trawled off Somalia at depths of 150 to 300 m. Because they have not divulged the exact locality, it is not known whether the specimens are from the Gulf of Aden or the Indian Ocean side of Somalia. Mr. T. C. Lan of Taipei, Taiwan, who obtained the specimens from the Taiwanese fishermen, has provided a list of associated species, some of which would appear to shed light on the locality of the pectinids. *Strombus oldi* Emerson, 1965, was originally described from the Indian Ocean side of Somalia in the vicinity of Obbia and Mogadiscio (Emerson, 1965), and recently it also has been found off Oman in the Arabian Sea (David Hargreave, *pers. com.*, 1986). It is not known to occur in the Red Sea or the Gulf of Aden. *Cypraea broderipi* Sowerby, 1832, *Cypraea marginalis* Dillwyn, 1817, and *Vasum truncatum* (Sowerby, 1892) are known mainly from the Indian Ocean and not the Red Sea (Abbott and Dance, 1982), and *Mimachlamys townsendi* (G. B. Sowerby III, 1895) is known mainly from the Arabian Sea off Pakistan and from the Gulf of Oman. Although these data suggest that *S. cranmerorum* is from the Indian Ocean side of Somalia, the fossil species that is morphologically the closest, *S. wyllei* (Cox, 1929), is from a raised beach on the Red Sea coast in Sudan.

The epifauna of the shells of *S. cranmerorum* gives some clues to living habits. The lower (right) valves of many of the uncleaned specimens are encrusted by cheilstome bryozoans at least in the dorsal region and in some cases extensively over the valve. This indicates that the lower valve was not buried in fine sediment and that the scallop must have lived attached by a byssus above the bottom or on a hardground bottom. The presence of calcareous algae on the upper valve suggests that the specimens lived in the photic zone, as does also their association with algal grazers such as *Strombus*.

Thirteen of the 52 specimens of *S. cranmerorum* examined have circular corroded patches within which a borehole occurs over the anterodorsal disk flank over the approximate position of the scallop's mouth. These features are identical to the scars produced by the calyptreacean gastropod *Capulus danieli* (Crosse, 1858) described by Orr (1962; see also Matsukuma, 1978) from another Indo-Pacific member of the Decatopectinini, *Bractechlamys vexillum* (Reeve, 1853). On the basis of gut contents, absence of damage to soft parts other than the mantle through which the boring passes, and evidence of repair and continued survival, Orr concluded that the snail-scallop relationship is one of antagonistic symbiosis, not true parasitism, the snail stealing food, probably in mucus strings, from the mouth region of the scallop. On all but one of the scarred and bored scallops, the shell damage is on the left umbo. The fact that gastropod was able to survive on the lower valve is additional evidence that the scallop lives attached above the sediment surface.

Etymology: This species is named in honor of Roberta D. Cranmer and her late husband, Charles E. Cranmer, of Louisville, Kentucky, whose personal involvement and quiet philanthropy have greatly benefited many people and organizations, a number of which have made significant contributions to malacology.

Holotype: USNM 859034, a pair of matching valves, height 50.0 mm, length 53.8 mm, convexity across closed valves, 15.5 mm, collected by Taiwanese fishermen off Somalia at a depth between 150 and 300 m.

Material: In addition to the holotype, USNM 859034, 51 paratypes were studied, all paired valves from the same locality at 150-300 meters off Somalia. Twelve of these paratypes are deposited in the U.S. National Museum of Natural History under the catalogue numbers 859035 (the paratype illustrated herein) and 859036 (eleven unillustrated paratypes). Thirty-one of the remaining paratypes were returned to Mr. Donald Dan, and one paratype was sent to each of the following eight museums: American Museum of Natural History, New York; Natural History Museum of Los Angeles County, Los Angeles; British Museum (Natural History), London; Museum National d'Histoire Naturelle, Paris; Rijks-museum van Naturlijke Historie, Leiden; Australian Museum, Sydney; Western Australian Museum, Perth; and National Science Museum, Tokyo.

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The possibility that the scallop shells from off Somalia were of a new species was first considered by Mr. Donald Dan of Maryland and Mr. Al Demartino of Naples, Florida, who brought specimens to my attention. I am particularly grateful to Mr. Dan for providing a large number of specimens for study, for underwriting the cost of donating some of these to the U.S. National Museum and other museums, and for providing encouragement and numerous helpful suggestions. Mr. Shin Rong Hwang of Taipei supplied Mr. Dan with the specimens obtained from the fishing-boat captain, and Mr. T. C. Lan of Taipei provided information on associated species. Mr. C. Patrick Nuttall and Dr. Noel Morris kindly provided access to and assistance with the fossil collections in the British Museum (Natural History). Drs. Harald Rehder and Richard S. Houbrick, Department of Invertebrate Zoology, Smithsonian Institution, and Dr. John Pojeta, Jr., U.S. Geological Survey, Washington, D.C., kindly reviewed the manuscript and offered suggestions for its improvement. My assistant, Mr. Warren C. Blow, prepared the prints and plates.

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A NEW SPECIES OF *TRITONIA* (NUDIBRANCHIA) FROM SOUTHERN CALIFORNIA AND BAJA CALIFORNIA

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ABSTRACT

Tritonia myrakeenae *is described as a new species from the Californian marine faunal province and is distinguished anatomically from the north Pacific and north Atlantic species of* Tritonia.

Although the opisthobranch gastropod fauna of the northeastern Pacific has been monographed extensively by numerous authors (e.g., recently by Marcus, 1961 a; MacFarland, 1966; Keen, 1971; McDonald, 1983; *et al.*), there are still numerous new distributional records (e.g., Bertsch, 1981; Behrens, 1982; Gosliner & Millen, 1984) and new species descriptions (e.g., Gosliner, 1981; Behrens, 1984; and Millen, 1985) being published. These add significantly to the known species of opisthobranchs that are endemic to this coastline or its various marine faunal provinces, or that are shared with other marine zoogeographic regions. In this paper we describe a new species of *Tritonia* that occurs in the Californian marine faunal province; the existence of this species was first reported over 5 years ago (Behrens, 1980).

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